WIRE & WIRE PRODUCTS

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The New Ford Wire Plant
By Carl Marx

Wire in the Delaware Bridge
By Charles Carswell

European Bolt and Rivet Practice
By Max Irmischer

Digest of Current Literature on Wire

Recent Patents

September 1926

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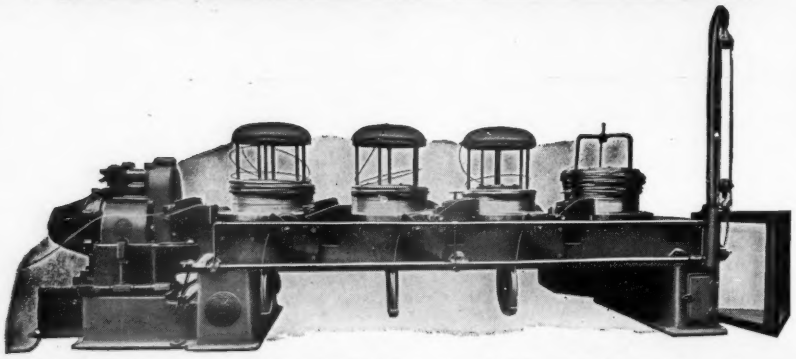
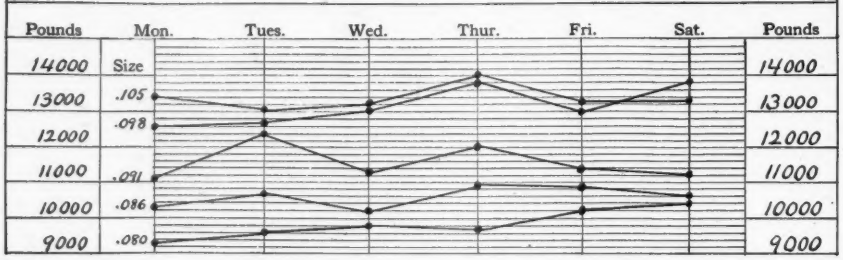
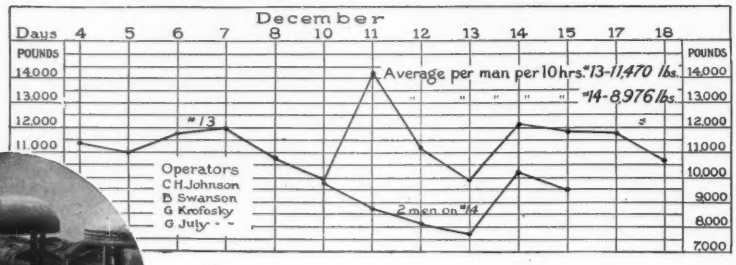
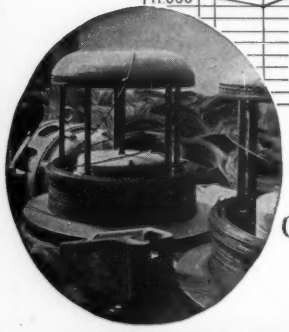


Production per man per shift (10 hours) from No. 5 Rod



High Output per Man
is the outstanding characteristic of the
Morgan-Connor Wire Machine





The chart above gives in the form of a composite curve the average output per man per day of four operators running eight machines at the Portsmouth Ohio Plant of the Wheeling Steel Corporation.

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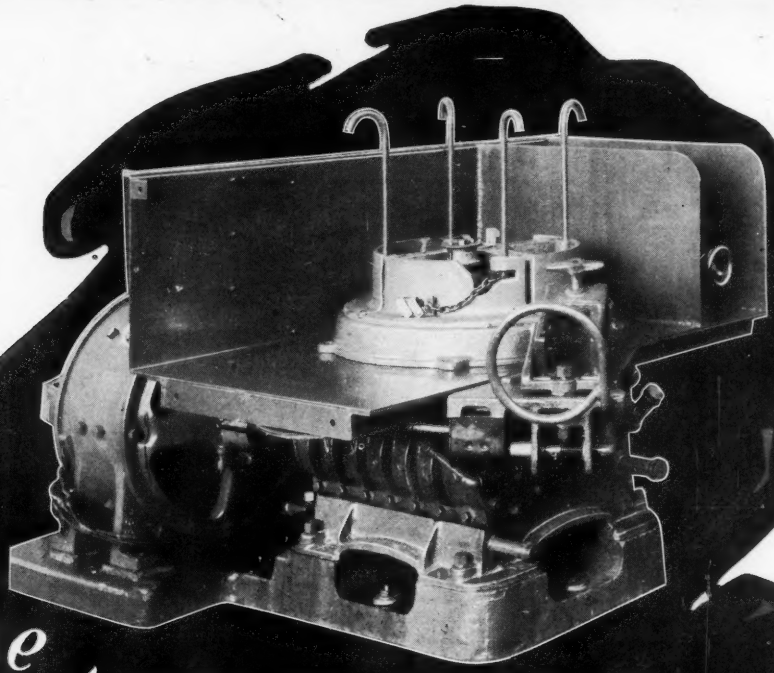

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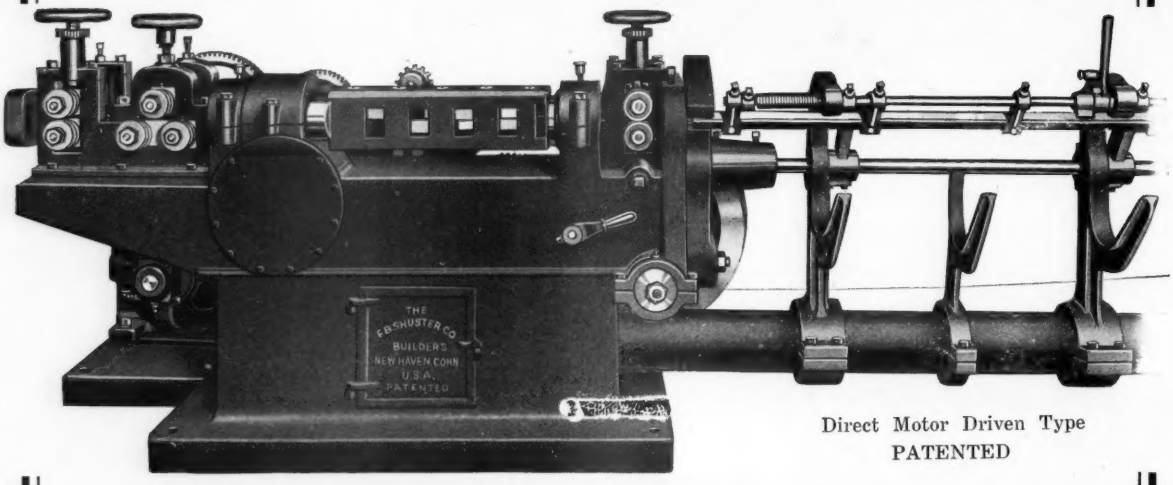

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Booklet of Installation and Production Figures will be sent on request.

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STRAIGHTENER SPECIALISTS

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A business paper is judged not only by the advertising carried, but by the amount and enthusiasm of its subscribers. Our circulation department informs us that at least one subscription has come in from almost every wire mill in this country, and many from Europe. It is also gratifying to know that hundreds of letters have been written by important men in the wire industry praising the publication and commenting on its value to the trade at large. We wish to thank here our friends for thesr numerous expressions of approval and encouragement.

Our pleasure in noting the encouraging reception afforded to the first issue was just a little marred by the fear that the enthusiasm of our reading public was aroused by the novelty rather than the permanent utility of our publication. But, on the eve of this fifth issue, we note the gratifying fact that rather than abating, this enthusiasm has steadily increased; if we may take increased circulation, increased contributions and more frequent technical inquiries as an index to our readers' interest.

In the past it has been our deliberate editorial policy to stress the wire drawing phase of the industry. But with a reading public in this field assured, we proceed to the second stage of our development and extend the scope of the magazine more definitely into wire forming problems, without however neglecting the treatment of wire drawing.

With this change we are releasing a quantity of valuable articles on the forming of wire products which were written expressly for us by noted American and European experts, and which have been accumulating in our editorial department.

We are confident that this new policy will be entirely welcomed by our readers, as it is launched in response to their expressed opinions.

The Publishers.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 1 September, 1926 No. 5

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WIRE
& WIRE PRODUCTS

Vol. I SEPTEMBER, 1926 No. 5

The New Ford Wire Plant

Unique installations and shop methods in the Wire Department of the Ford Plant

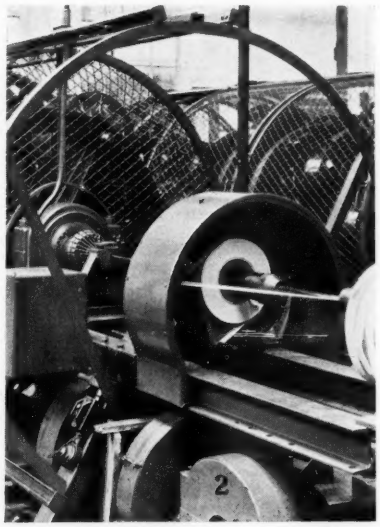
By Carl Marx

UP to a few years ago, the large amounts of wire required for the production of the Ford car were purchased by the Ford Motor Co. In line with the policies of Mr. Henry Ford, to make the plant, as far as possible, independent of outside suppliers of essential raw materials, the construction of a complete copper wire and cable plant was undertaken.

Work was started in the latter part of 1924, and at the present time (June, 1926) no less than 7,600 square feet of space, in the Highland Park plant, are devoted to the multitudinous operations of wire-drawing, braiding bunching, cable-making, covering with cotton and silk insulation, rubber-coating and making up into loom and assemblies for use on the Ford car.

The present output of the copper-wire plant is 60,000 lbs. of wire per day, and this is to be increased to a maximum of 96,000 lbs. per day in the near future. The products now being manufactured comprise:

Bare wire, flat wire, paper-covered wire (both round and flat), enamelled wire (all sizes), cotton covered, silk covered, tinned, and rubber covered wire as well as all the thicknesses and sizes of copper cables and braided thin copper wire for special uses.

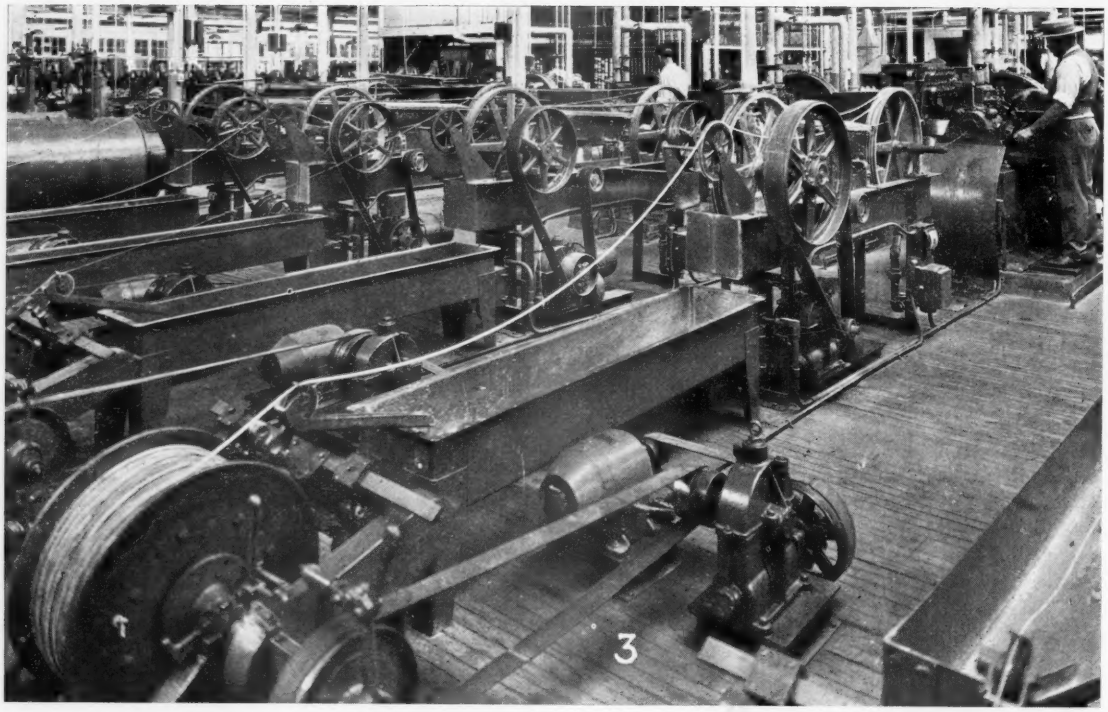


A specially designed machine in the Ford Wire Plant, wrapping paper about the cable as it comes from the strander.

At the present time 520 men are employed, there being two shifts on the drawing, covering and assembly jobs, and three shifts on the enamelling ovens. An especially interesting point is that Ford employs a great many partially disabled men in this department. For example in the final assembly of ignition wire harness for the low-tension lines on the car, only five able bodied men are employed, with one hundred and sixty-three partly crippled operators attending to the various detailed manipulations.

The entire plant is on one floor, and conveyers, now under construction, will provide adequate means for shifting reels of wire from one department to the other with a minimum of manual labor.

The raw material used for all the copper wire made in the Ford plant is $\frac{5}{16}$ inch copper rod. This is furnished in coils approximately 215 lbs. in weight. The first operation is the breaking down of this rod into smaller sizes of wire. After the coils of copper rod have been immersed in a tank containing hot water and tallow, to furnish a lubricant to the surface of the copper, the rod is pointed by hand, a special machine being used. Following this the rod is threaded through a series of nine chilled iron dies, and the rod drawn down in a



The entire manufacture of the cable now takes place in the Wire Department of the Ford Plant. The illustration shows the cable being insulated (right background), soapstoned (mid-ground) and reeled ready for vulcanizing (left foreground.).

9-draft Waterbury-Farrell machine into 0.091″ wire.

The intermediate stages used, from the original ⅜ inch rods are: 0.312″, .259″; .194″ 0.164″; 0.138″; 0.120″, 0.102″, 0.091″. The production of the 0.091″ wire is at a rate of approximately 1,000 feet per minute. The present equipment for this work consists of five 9-draft and one 5-draft machines. With the exception of the larger sizes all pointing of wire is done by heating in a gas flame and pulling the wire apart.

The dies used in these machines are chilled iron, of about 560 to 600 Brinnel hardness, each die lasting long enough to make about 4,400 lbs. of wire, after which the dies are reamed out for a larger size.

After the wire has been broken down to the 0.091″ size as already described, it is necessary to anneal it, as the drawing has rendered it too hard for further working. This is done at the Ford plant by heating to 1140 degrees F. for one hour, out of contact with the air, followed by quenching in water. Three 42″ and one 30″ Kenworthy Non-Oxidizing electrically heated annealing-furnaces are used for this work. The wire is handled mechanically throughout the operation.

It has been found advisable to dry the wire after annealing this being accomplished by re-spooling the wire, and at the same time directing a powerful blast of air upon the wire while it is passing from one reel to the other.

Further reduction in size is brought about by passing the 0.091″ wire through a Cone machine, of which there are at present thirteen installed. This reduces the wire to a diameter of .0438″ in the following stages: 0.091″ (starting size), 0.081″; .072″; 0.064″; 0.057″; 0.0508″; 0.0471″, 0.0471″, 0.0438″. The latter corresponds to about No. 17 B & S. Guage.

The smaller sizes of wire, of which a very large amount is produced, are made on imported Swiss machines. Two different types of these machines are used, there being six of the intermediate type and eleven of the fine wire type. One type reduces the wire from No. 19 guage in 13 drafts, diamond dies being used throughout. The other machines reduce the size further from No. 29 to No. 48 in the same number of drafts. The speed of the latter machines, based on No. 39 wire is upwards of 4000 feet per minute.

The reduction in size of the wire on these machines is as follows: Starting No. 19 wire (0.0438″) 0.0401″; 0.0361″; 0.0323″; 0.0298″; 0.0.258″; 0.0231″; 0.0206″; 0.0184; 0.0165″; 0.0147″; 0.0132″; 0.0118″; 0.0113″ (No. 29.) The fine wire machines further reduce this from No. 29 through stages of 0.0101″; .0093″; 0.0086″; 0.0080″; 0.0074″; 0.0068″; 0.0063″; 0.0058″; 0.0054″; 0.0050″; 0.0046″; 0.0042″; 0.0039″.

The finer sizes in some cases, due to the speed of drawing, are soft enough for the purpose, the heat generated in the drawing being sufficient to anneal the

wire. Annealing is resorted to, however, where dead-soft wire is required.

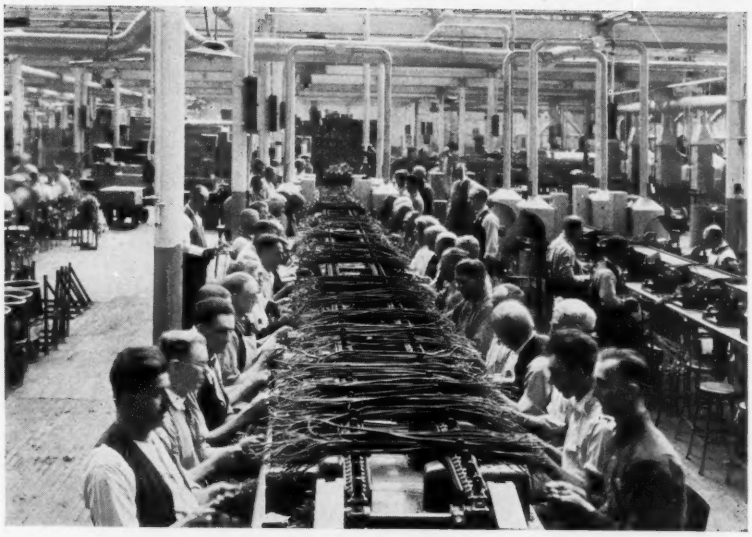
The only lubricant used on all the copper-wire drawing-machines used in the plant is a solution of soap, tallow and water. This is kept in large underground reservoirs and is pumped by an elaborate piping system to all of the drawing machines used, as well as to the flat-wire rolling machines.

Flat Wire

Considerable amounts of flat wire are also manufactured at this plant, although only in relatively large sizes. This is made on rolling-mills which first break down regular round wire between two pressure-rollers, and then bring it to its final size between another set of rolls. At the same time an edging tool or roll straightens the flat-wire and gives it the proper finish.

The cable department is part of the wire-mill proper, located on the same floor and separated only by the enamelling room, which will be described shortly. There are at present installed one 19-strand cable-machine and two 61-strand cable machines. Also five of their "bunching" machines which turn out a soft wire cable having 41 strands, for use as high-tension spark-plug cable. The speed of the 19-strand cable machine is about 5 miles per hour and that of the 61-strand machine 1000 feet per hour.

In addition to the large and small cable made, a certain amount of No. 31 bare copper wire is braided into a three-strand braid, for use in making various connections in the Ford magneto.



A view of the clean, efficiently illuminated Ford Wire Plant. Ford employs a large number of partially disabled men in this department.

Tinning

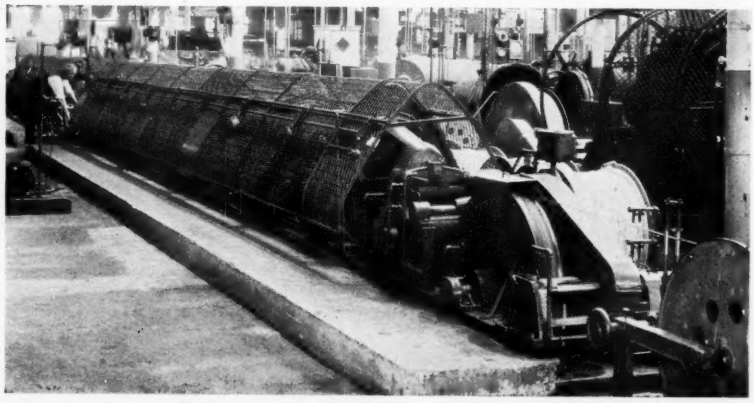
A large amount of the wire used in the Ford car is tinned. For most purposes, and especially for the flat-wire. The wire passes successively through acid, to clean it, through molten tin, through a wiper, then through water, another wiper, and is then reeled up. It is interesting that the Ford Motor Co. has found common soft rubber to be the best material for wiping the tinned wire. The round wire is tinned in practically the same manner.

Contrary to usual wire-mill practice, only perfectly pure tin, free from lead, is used for the tinning. This is done because the heat of the tinning bath is sufficient to dissolve a certain amount of the copper from the wire, so that eventually there is quite an accumulation of copper in the tin, gradually raising its melting point, so that it must be discarded. The coppear-bearing tin is then analyzed, and enough copper added to it to bring it to the proper composition for the brass needed in the construction of the Ford car. If any lead were present in the tin, it would render this method of reclamation impossible. This is an excellent example of the way waste is eliminated in the Ford plants.

The tinning of the wire is necessary in such cases where the wire is to be covered with rubber, as otherwise the sulfur used in vulcanization of the rubber covering would combine with the copper to form copper sulfide, blackening the wire and interfering with the proper adhesion of the insulation.

In addition to tinning, some of the flat, as well as round, copper wire is covered with paper. This is cut into thin ribbons and placed about the wire and specially designed machines. The wire first passes through an adhesive, and then the paper is applied, the wire and covering finally passing through a heated drying chamber to insure elimination of all moisture.

The insulation and enamelling of wire and the manufacture of diamond dies in the Ford Plant, will be discussed in the October issue.



▲ nineteen bobbin stranding machine in the Ford Plant, with a capacity of about twenty thousand feet of cable per eight hour day.

The Profits of High Overhead

PART II

How a great wire company has secured and maintained a lead through intelligent use of high overhead expenses

By L. S. Horner
Vice President, The Acme Wire Company

OUR research and development work is carried on in several ways. In the first place, we are constantly studying our raw materials and processes.

By a scientific study of our finished product, we have managed to attain a high degree of uniformity. Most of the magnet wire we make is eventually wound into coils of one sort or another. Uniformity of diameter, for example, means that the user needs to leave only a minimum leeway in the space the wire is to occupy on the coil. A given number of turns of a given size of our wire will always occupy the same space on the coil.

And we carry this same idea all the way through. We noticed that the empty spools or containers for fine wire, cost $2 to $10 a pound, were coming back to us from one of our customers in a damaged condition. An inquiry developed that in the handling of this wire, in the incoming inspection and manufacturing departments of the customer's plant, the wire was being damaged in moving stock.

Our engineers tackled this seemingly simple problem; it turned out to be a good deal less simple than it looked. But eventually we arrived at an answer to the whole difficulty. Now we first place these expensive spools of wire in a paper tray and carton, placing a number of trays in a big carton.

When a shipment comes to the customer's incoming inspection department, each spool is taken out, inspected, and put back in the tray. Then all of the trays are put back in the container, or one or more trays of spools are sent to the manufacturing department, depending on the job requirement. As the operator uses the wire, he puts the empty spool back into the tray. The tray of empties is sent to the shipping department, which accumulates a carton of them. The full carton is shipped back to us.

This insures protection to the spool in the plant. The saving, divided between the customer and ourselves, is enormous.

Extending Research Beyond Our Product

We do not find it necessary to confine our research to points directly connected with our products. For example, the question came up in the electrical industry a few years ago as to what kind of varnish should be used for impregnating a coil made of enameled wire. That affected the use of enameled wire, which is one of our principal products.

So we made a thorough study of the facts. We ran exhaustive tests to find out what varnishes were best for the purpose. Then we sent out to all of our customers the names of three varnish makers who could supply a varnish satisfactory for the purpose.

Thus the first result of our research was that we helped to make enameled wire more useful, more uniformly satisfactory, which increased our market and that of all other manufacturers of enameled wire. The second result was that we performed a definite service for the whole electrical industry.

We have small experimental and control laboratories, each one of them well equipped and in charge of an able man; all the work is under our chief research engineer. In these laboratories we run regular controls on our production. But quite as important a function of each one is that in it ideas are worked out in the particular sub-division of our field with which that particular product is concerned.

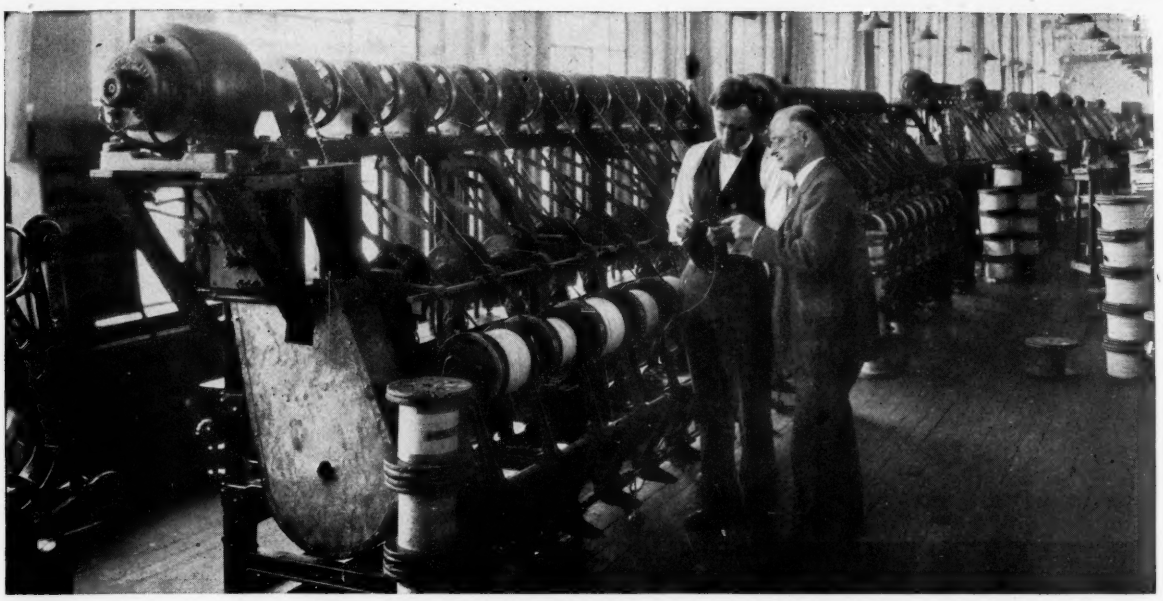
Out in the operating departments, however, the bulk of our experimental work is carried on. In some of the departments laboratory equipment is set up right alongside the machinery devoted to regular production. Usually this equipment is simply regular plant machinery devoted exclusively to experimental and developmental work.

At each of these shop laboratories is stationed a crew of anywhere from one to three technicians. They do an amount of experimenting on their own accounts. More particularly, however, they work at the job of putting into commercially practical form the ideas which have been developed in the laboratory proper.

After a new product has been developed and a quantity of it made up on the experimental machines, it goes out to a group of friendly customers who use the present product which it is thought the new one may supplant. They are asked to build it into their own product, and try it out in the field.

A Force of Service Experts

Perhaps the least usual of our activities which contribute—profitably—to our "high overhead" is embodied in our force of service experts. These men visit customers' plants to see how we can improve our prod-



Perhaps the least usual of our activities which contribute—profitably—to our high overhead is embodied in our force of service experts. These men visit customers' plants to see how we can improve our products so that they will work more satisfactorily in our customers' products.

ucts so that they will work out more satisfactorily in our customers' products.

We have only a small number of industrial accounts on our books—a small number in comparison with the size of our business—and consequently are able to give this sort of service where it would be impossible if our average customer bought, say, only a few dollars' worth of goods from us in a year. But let me point out, parentheticall-ly, that in principle what we are doing is possible whether a concern has 2 customers or 2,000. The mechanism for doing it would, of course, have to be varied.

These service experts visit customers on regular routine visits. When they are not on the road they are in our plant working out, with our engineers, the answers to the problems they have found confronting them in the customers' plants.

These service men have nothing to sell; they travel to keep us in touch with and working on the actual production problems of our customers.

For example, one of our customers who maintains a very considerable staff for the study of processes and labor-saving devices in his own plant, devised an automatic winding machine which increased the output of each operator about 100%. The high speed of the machine caused too great a strain where the wires passed each other going into the slots.

Our service men got on the job, studied the trouble they were having, suggested a heavier cushion of fabric with a change in construction. This remedied the trouble. In fact, it permitted the increased output, at an even greater saving in cost than had been at first contemplated as possible.

A great saving in the amount of defective product

Another one of our customers decided to try out a type of insulation which cost less than the kind he had been using; even more important, the new type required less space for a given number of turns.

Here, again, complications arose. The cheaper material was damaged in the winding process, largely because of the weight on each container.

Our men studied that problem, and devised a method of taking the wire off the spool vertically instead of horizantally. This took all the strain off the wire, and the winding was a success. This resulted in a great saving in the amount of defective product turned out by this customer.

Typical of another sort of results often attained and of the way we are able to make use of them both in helping the customer and in helping ourselves, is an incident which came up recently. One of our service experts, working over the problems of an electric-motor manufacturer in his plant, found that, instead of using material which cost 30 cents a pound, the motor could be made better and at less expense by using one of our specialties at 34 cents.

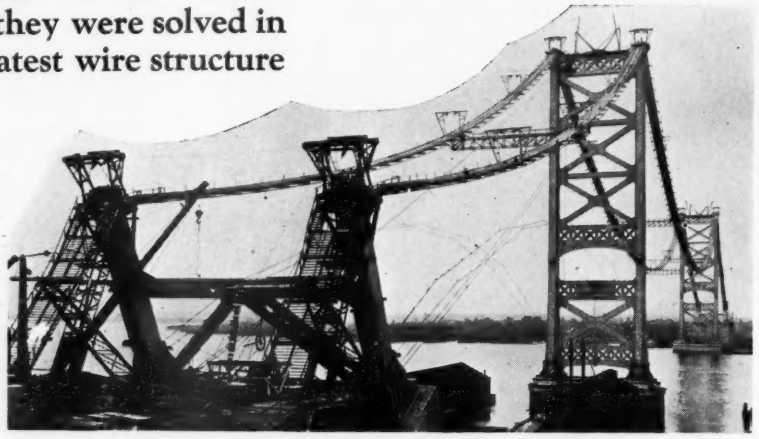
It was a matter of the manufacturing expense. Using the 30-cent material meant an additional manufacturing cost of about 10 cents for building the material into the motor. Our 34-cent product, because it increased the output of a particular machine, would go in with less than 5 cents in manufacturing cost. So the cost of the higher-priced product, built into the machine in the quantity required, was under 22 cents, while the lower-priced cost 26 cents.

(*Continued on page 176*)

Wire in the Delaware Bridge

Unique problems in the use of wire and how they were solved in the world's greatest wire structure

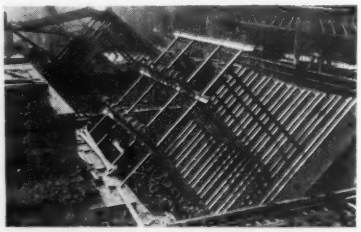
By Charles Carswell
Assistant Engineer,
Del. River Joint Bridge Commission



Beginning the spinning of the cables.—Reels mounted at the anchorage and the sheave just being started across.

OF THE many thousands of uses to which wire is put, perhaps none is so fascinating to the imagination as its function in supporting bridges that span great rivers. There is boldness of conception in the use of slender strands of wire for the support of bridges carrying heavy burdens of traffic; there is charm of natural grace in the curves of the cables; and there is added fascination in the means of construction—the aerial method of building the wire cables.

Among the many examples of wire cable bridges the most notable is the Delaware River Bridge connecting Philadelphia, Pa., and Camden, N. J., which was opened to traffic July 1, 1926. The two cables of this bridge support a main span of 1750 feet—the longest suspension span in the world and the longest span of any type of bridge in the United States. As many as 6,000 vehicles have crossed this bridge in one hour and over one and one-half million vehicles have passed over it



Erecting girders and eyebars which hold cable strands in place at the anchorage.

since the opening two months ago.

The Delaware River Bridge is primarily a highway bridge, connecting at a vital point the highway systems of New Jersey and Pennsylvania. The roadway is 57 feet wide between curbs and accommodates six lines of traffic abreast. Four track spaces stand ready for the rapid transit which soon will be required between the growing communities, and two footwalks, each ten feet wide, are provided at a higher level.

The wire cable suspension bridge was decided upon for this structure as the most economical and best adapted to the requirements after study by the Board of Engineers of different types of long span bridges.

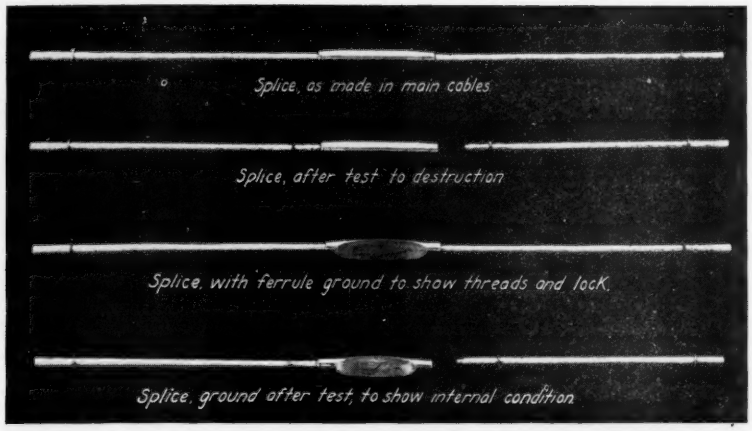
The bridge has a total length, including approaches of 1.8 miles. At the end of each approach, a plaza is provided for the distribution of the traffic. From these plazas the roadway rises on 3¼ per cent grade to the suspended spans, which comprise the main span of1750 feet and two side spans of 720 feet each. The main span affords a channel clearance of 135 feet above mean high water in the river—sufficient to permit the passage of all the ships of the United States Navy and of practically all vessels in the world.

The suspended spans are hung from two cables, each 30 inches in diameter and each composed of 18,666 individual parallel steel wires. These cables are the largest ever built, the previous maximum size having been the 21¼-inch cables of the Manhattan Bridge over the East River in New York, each of which contained 9472 wires.

The Towers and Anchorage

The cables are supported upon steel towers rising 380 feet above the water and resting upon granite and concrete piers founded on bed rock. The towers are of cellular construction, designed to deflect with changes of the cable length due to change in loads on the spans and in temperatures. They are constructed of silicon steel, a material particularly adapted to heavy duty as it is fifty per cent stronger than the ordinary grade of bridge steel. The tops of the towers can bend 20 inches toward the shore or 20 inches toward the river without damage to the steel. The piers upon which the towers rest are of ashlar granite masonry backed with concrete. They were founded up rock by the use of pneumatic caissons, a single caisson 70 by 143 feet in plan being employed for each pier. The Philadelphia pier extends to a depth of 58 feet and the Camden pier to 82 feet below high water.

At the ends of the side spans, the cables are held in place by


Splice, as made in main cables
Splice, after test to destruction
Splice, with ferrule ground to show threads and lock.
Splice, ground after test, to show internal condition

Cable wire splices. Although only 83% of the metal is retained at the weakest part of the splice, it has over 95% of the strength of the rest of the wire.

attachment to anchorages of massive construction, of concrete masonry faced with ashlar granite. The two anchorages together weigh over 400,000 tons. Like the main piers, they are founded upon bed rock. The anchorage foundations were constructed as reinforced concrete open dredged caissons, two rectangular and twelve circular caissons being employed for each anchorage. The rectangular caissons were 40 by 125 feet in plan on the Philadelphia side and 40 by 140 feet in plan on the Camden side and are believed to be the largest cassions of this type ever used. The Philadelphia caissons are founded at from 59 to 61 feet below high water and the Camden caissons at from 90 to 103 feet below high water. At each anchorage, supported upon the concrete and granite masonry, is an inclined steel post, known as the anchorage bent. The wire cables rest upon this post and are deflected downward over it to the angle required for their anchorage into the masonry. The bent is similar in construction to the towers and is made of the same grade of steel.

Attachment of the wire cables to the anchorage masonry is effected by systems of steel eyebars and girders. The eyebars spread out fan shape from their point of attachment to the cable strands and are pin connected to steel girders placed in the masonry just above the foundations.

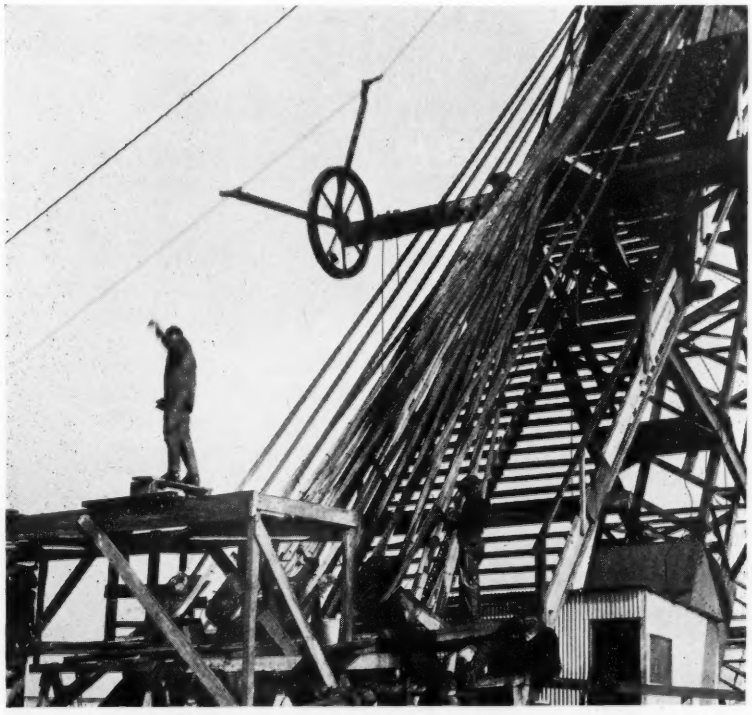
The Main Cables.

The wire for the main cables is made of the highest grade and open hearth steel. It has a diameter of 0.195 inch and averaged 221,000 pounds per square inch tensile strength. Over 25,000 miles of wire, weighing 6800 tons, are contained in the two cables. The strength of the wire was developed by the cold working in the process of drawing, five drafts being used to produce the finished wire from original 3/8-inch rods. The wire is galvanized with a coating of 99.75 per cent pure zinc applied by the hot-dip process. The temperature of the zinc bath and the speed at which the wire is passed through it are carefully regulated in this operation, to prevent loss of strength of the wire.

Splicing the Wires.

Splicing of suspension bridge wire is an exacting problem that has been very effectively solved. The ends of the wires which are to be joined are given right and left hand threads and the tips mitered forty-five degrees. A slender steel ferrule is threaded on to both wires until the mitered ends overlap and lock inside the ferrule. The threads are swedged on the wire by machines hitting twenty-four hundred blows a minute and through this hammering the strength of the wire is raised so that the splice has over ninety-five percent of the strength of the balance of the wire, despite the fact that there is only eigthy-three percent of the

(*Continued on page 172*)



The travelling sheave started across the river with a loop of cable wire. Large reels containing about 90,000 feet of wire were mounted on the anchorages, and unwound as the sheaves moved across the river.

The Manufacture of Steel and Iron Wire in Germany

Important photomicrographs of iron-carbon structures in wire

By Dr. H. Altpeter

(Translated from Stahl & Eisen, 1925, By Carl Marx)

ALTHOUGH the general process of making steel wire is quite analogous to that of producing iron wire, there are a number of factors in respect to steel that require a different preliminary treatment when steel is to be drawn into wire. If the steel is drawn without any special preparation to render it ductile, only a few drafts can be made on it before it becomes necessary to anneal it. Ordinary soft iron wire with a carbon-content of about 0.01% is practically unaffected by heating followed by quenching, but steel wire, especially if the carbon-content is fairly high, is very much influenced by such treatment.

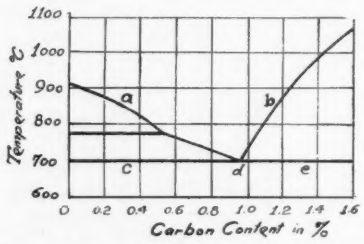


Fig. 1. Iron-carbon structures. (a) Start of Ferrite formation. (b) Start of Cementite formation. (c) Ferrite and Perlite. (d) Pearlite. (e) Cementite and Pearlite.

Steel containing from 0.85 to 0.95% Carbon, as a eutectoid, has a so-called pearlitic structure; with higher carbon-content it usually exhibits more numerous fields rich in cementite when examined microscopically. With lower carbon content, areas containing ferrite become more pronounced. By hardening the steel it can be converted into a form of Sorbite or Troostite. These exhibit an exceptionally fine-grained structure, which renders them amenable to the drawing operations and capable of standing considerable stresses.

This type of structure can be obtained, depending somewhat upon the carbon-content, by heating the steel to above 700-°C, usually to from 800 to 900-°C, and then rapdily cooling to a temperature between 430 and 500°C; this being usually done in a molten lead bath. The temperature employed is regulated in accordance with iron-carbon diagram (see fig. 1).

An ordinary steel wire becomes so brittle after from three to four drafts that it is necessary to anneal it, while the same steel wire, if properly treated preliminary to drawing, will withstand from 8 to 12 drafts without losing its ductility, or decreasing in resistance to bending or torsion.

The manufacture of steel wire is based upon the proper choice of steel, the accurate control of its hardness and other physical characteristics, and the degree of hardness attainable as a result of the drawing operations themselves.

Table 3, which gives the carbon-content, strength and elongation of rolled steel wire, will be useful in following the discussion relative to the hardening operations.

Table 3. Carbon content, strength and elongation of rolled steel wire.

Carbon	Strength in kg. per square millimeter	Elongation
0,10	45 — 47,5	26—30
0,15	47,5— 50	24—27
0,20	50 — 55	21—25
0,25	55 — 60	18—22
0,35	60 — 70	16—20
0,45	70 — 80	14—18
0,55	80 — 90	9—15
0,65	90 —100	3—10
0,75	100 —105	0— 6
0,80	105 —110	0—

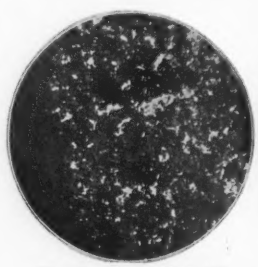


Fig. 2a. Magnified 118. Outer-zone, Transverse.

Fig. 2b. Magnified 118. Inner-zone Transverse.

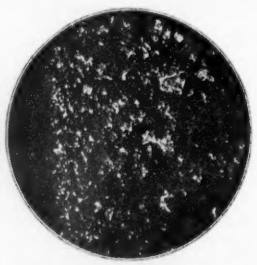


Fig. 2c. Magnified 118 Outer-zone, Longitudinal.

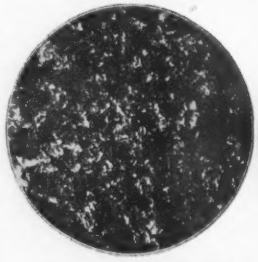


Fig. 2d. Magnified 118. Inner-zone, Longitudinal.

Fig. 2e. Magnified 600. Outer-zone, Transverse.

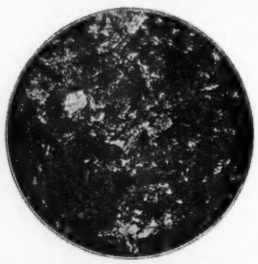


Fig. 2f. Magnified 600. Inner-zone, Transverse.

Transverse and Longitudinal sections of drawn wire 0.85% C. The temperature was purposely made too high in order to make its influence on the structure more evident. With 0.85% C a temperature of 750-800° Centigrade was sufficient. In the longitudinal section only a very small elongation is noticeable. (All photomicrographs shown in this article are 0 6 of original size.)

Fig. 3a. Magnified 118. Outer-zone.

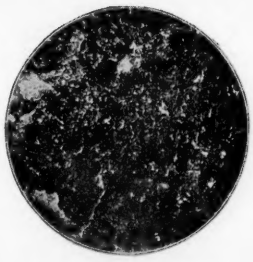


Fig. 3b. Magnified 118. Inner-zone.

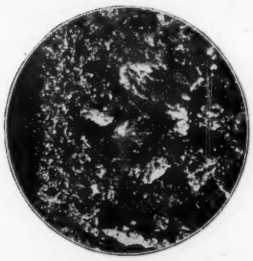


Fig. 4a. Magnified 118. Outer-zone.

Fig. 4b. Magnified 118. Inner-zone.

Fig. 3c. Magnified 600. Outer-zone.

Fig. 3d. Magnified 600. Inner-zone.

Fig. 3. Heated between 800 and 900° Centigrade for ½ hr. and allowed to cool slowly. Lamellar Pearlite. The outer-zone shows a stronger Ferrite formation due to decarbonization.

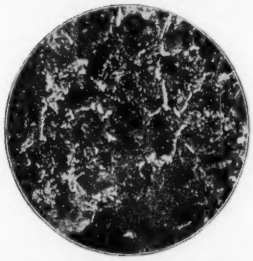


Fig. 4c. Magnified 600. Outer-zone.

Fig. 4d. Magnified 600. Inner-zone.

Fig. 4. Heated at 850°C for ½ hr and cooled in lead bath of 450 to 500°C. A decarbonized outer-zone is noticeable. No lamellar formation can be recognized at increased magnification.

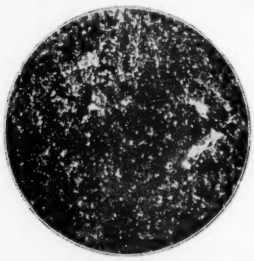


Fig. 5a. Magnified 118. Outer-zone.

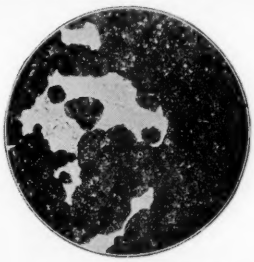


Fig. 5b. Magnified 118. Inner-zone.

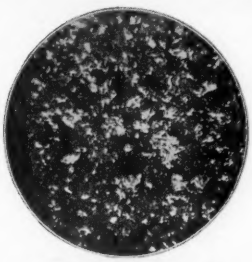


Fig. 6a. Magnified 118. Outer-zone.

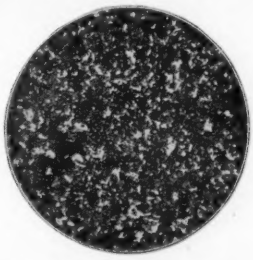


Fig. 6b. Magnified 118. Inner-zone.

Fig. 5c. Magnified 600. Outer-zone.

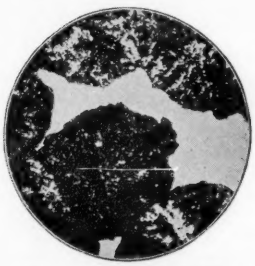


Fig. 5d. Magnified 600. Inner-zone.

Fig. 5 Heated to 850°C for ½ hr. and hardened in oil at 30°C. Troostite masses with Martensite embedded.

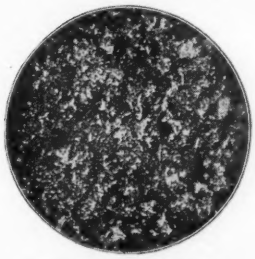


Fig. 6c. Magnified 600. Outer-zone.

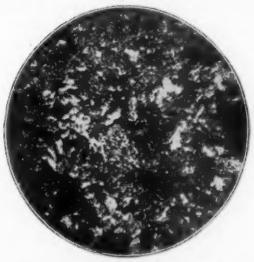


Fig. 6d. Magnified 600. Inner-zone.

Fig. 6. After treatment according to Fig. 5, tempered in lead bath 400°C. Sorbite formed from the fine grained Troostite.

Fig. 5e. Magnified 900.

Showing the "needle"-formation in one of the Martensite fields in Fig. 5a-d.

Fig. 7b. Longitudinal.

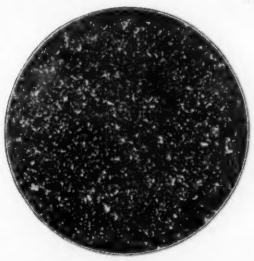
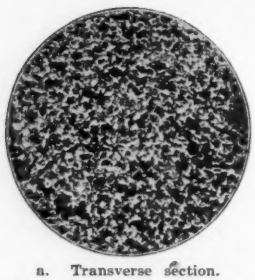
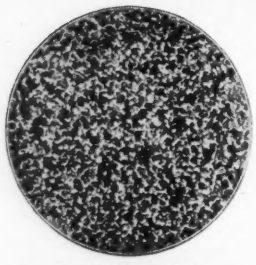


Fig. 7a. Transverse.

Fig. 7. Magnified 118. Cast steel wire with 0.64% C. Disintegrated Pearlite. The elongation of the structure in the Longitudinal section is very small.



a. Transverse section.



b. Longitudinal section.

Fig. 8. Magn. 118. Cast-steel with 0.64% C. Heated at 800°C for 1 hr. and slowly cooled. Ferrite-Pearlite. Lamellae are not noticeable at this small magnification.

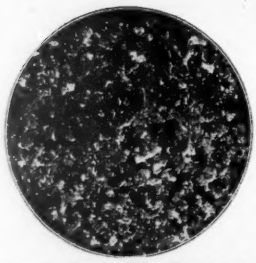


Fig. 9. Magn. 118. Transverse. Cast steel 0.64% C. Heated at 800° for 1 hr. and cooled in lead bath at 420°C.

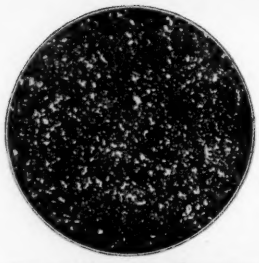


Fig. 10. Magn. 118. Transverse section. Heated at 800°C for 1 hr. Quenched in oil 20°C. Pure Troostite.

If the wire is to be given special properties, after it is otherwise completed, it is usually submitted to a treatment which consists in heating it to above 700°C, followed by quenching in either water or in oil, and then reheating to from 400 to 600°C to temper the wire and to produce either a troostic or sorbitic structure.

Formerly the various hardening processes were merely a matter of skill, but modern methods make use of metallographic studies to control these operations to a nicety. By taking cross-sections of the wire, polishing the same and examining them microscopically it is possible to closely supervise the various hardening and tempering operations and to determine the proper temperature of the lead-bath through which the wire passes, as well as the speed with which it travels.

In the figures 2 to 11 an attempt has been made to show the changes in structure of two different steels (containing 0.85 and 0.64% carbon respectively) when they are subjected to varying treatment. True sorbitic or troostic structures are rarely met with in actual practice, but transitional stages are usually found; and it is a matter of considerable concern to those in charge of the operations to make certain that the wire will have the structure demanded of it by the service for which it is intended.

The treatment to be used is the determining factor in choosing the amount of carbon which should be present in the wire. Another point to be considered is whether the wire purchased is supposed to be a completely finished product, ready for use or is to be treated by the user. In the first group, that is the group purchasing wire ready for use, comprises wire for wire-rope, music wire, and high grade spring-wire. The second group contains wire suitable for the

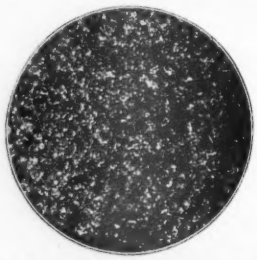


Fig. 11. Magn. 118. Transverse. Cast steel 0.64% C. Wire treated as in Fig. 10 and tempered in oil 320°C for 1½ hr. Troostite and incipient Sorbite formation.

manufacture of needles, umbrella-ribs, knitting needles, second-quality spring wire, as well as wire that is to be fabricated into steel ballbearings and drills. The latter group contains wire that it usually submitted to various hardening and tempering operations by the user, depending upon the ultimate properties required in the product.

For the production of wire-rope, it is usual to employ rolled wire made from what is sometimes termed "Patent cast-steel" which is an open-hearth steel of special composition, or, more recently, electric furnace steel containing from 0.4 to 1.0% of carbon, 0.3 to 0.5% manganese, 0.07 to 1.13% silicon, but otherwise quite free from impurities. For music wire, especially for pianos and similar musical instruments, as well as for high-grade springs, wire containing still more carbon is used. This may run as high as from 0.7 to 1.1% C. Spring-wire to be used for making springs which are given a heat-treatment after forming, may contain only from 0.4 to 0.6% carbon. For the manufacture of pins and knitting needles, a good, hardenable open-hearth or Martin steel will do. Wire used for cutting clay and marble, on the other hand, must be very hard, and it is therefore necessary that such wire contain a rather large amount of carbon.

Belgian Mills Are Dissatisfied With Agreement

It is credibly reported from Lubeck, Germany, that the agreement of German and Belgian wire rod makers covering production prices and distribution may be abrogated. Discrepancies in prices to British markets are beginning to appear, while Belgian mills are reported to be dissatisfied with their quotas of British business Should this agreement collapse, destructive competition in European and overseas markets is certain.

Although the German Wire Syndicate includes about 98 per cent of the wire production of Germany in its membership, its control of prices is evidently far from complete. Members seeking business offer concessions from the official prices of the association, quite freely at times For example, bright iron wire is quoted by the syndicate at £7 ($34.02) per metric ton, and has been sold at £6 10s. ($31.60), galvanized wire is officially on a base of £9 ($43.75), but has sold at £8 15s. ($38.88) per metric ton.

European Bolt and Rivet Practice

Recent improvements in "cold-upsetting" process for bolts and rivets

By Max Irmischer

THE steadily increasing demand for bolts and rivets of the modern industry and the thereby stimulated competition among the manufacturers of bolts and rivets is forcing these manufacturers to find new ways and means to improve their manufacturing processes in economical respect. There are only two possibilities: Either the production obtained from the machinery of the plant has to be increased, the expenses for operation being the same, or on the other hand, if this is impossible, the expenses for operation must be reduced while the figures of the production remain the same. Very often this can be carried thru successfully to a certain

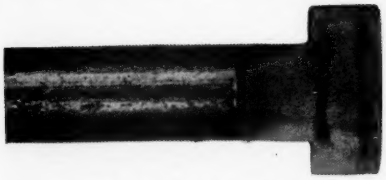


Fig. 1. The etched cross section of a bolt shows the breaking of fibres at the neck.

limit. For the "hot" processes these limits were already reached and further improvements could not be found in either of the mentioned ways. The best solution remained in changing from the "hot" processes to the "cold" manufacturing methods. Many of the modern plants have done so and the economy of the "cold" processes was proven within a short time.

The following comparison shows:

A hot working forging plant for bolt heads gives an output of about 24,000 bolts of ⅝" diameter within 8 hours. Required are:

Machines:
1. shearing machine
4. forging machines
4. heating stoves

Total: 9 machines

Operators:
1. unskilled laborer
4. operators
4. boys

Total: 9 laborers. About 1,000 kg. coke.

A cold-working double-stroke press turns out about 24,000 bolts of ⅝" diameter within 8 hours.

There are used:

Machines:
1 cold-working press
1 trimming machine

Total: 2 machines

Operators:
1 laborer
1 girl
1 man for annealing

Total: 3 operators. About 300 kg. coke.

The economcial advantages of the cold process being a matter of course, it was necessary nevertheless to obtain the same exactness and neat finishing for the bolts and rivets—especially for those with large heads—as in the "hot" process. These requirements were fulfilled by steady improvements of the ingot-iron with respect to upsetting properties and quality and by further perfection of the cold-working press. In addition to the unjustified prejudices which such an innovation has to meet, there was another difficulty to be overcome. One knew

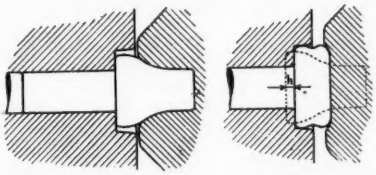


Fig. 2. Showing the formation of the head. To avoid shearing stresses at the neck of the bolt, it is made to advance an amount "h" during upsetting.

from experience that the heads of bolts which were subjected to a pressure from two sides, broke off sometimes while passing the trimming machine, sometimes later when being used. Even though this might be due to the use of materials not quite free from defects, it is nevertheless remarkable, because such failures should not occur on slight

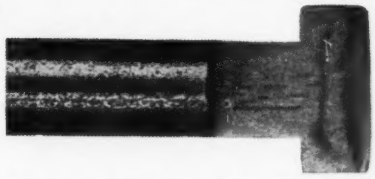


Fig. 3. Compare with Fig. 1. The fracture of fibres as shown by the etched surface occurs near the center of the head as a result of upsetting according to Fig. 2.

changes in the quality of the material. This question was answered by inspecting the structure of the material which was influenced by the pressure. A minute inspection of the broken section showed that it was of blue color with a redish shade, proving thus that the cause for the breaking was present before the annealing. The etching of a clean ground cross section of head and shaft (Fig. 1.) shows that a breaking of the fibres of the material occurred between head and shaft, a breaking by which the dangerous section was weakened if not destroyed.

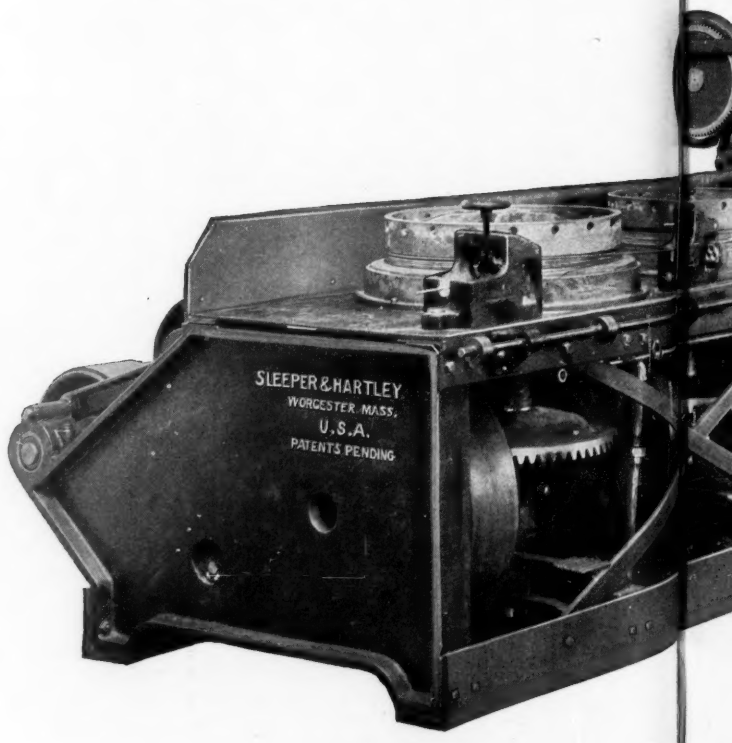
Let us consider now why the breaking of the fibres took place just in this section. It is known that during the first upsettintg and the final pressing there occurs an upsetting of the shaft. For this reason the diameter of the material is chosen smaller than the diameter of the finished shaft of the bolt. For instance if—in case of a bolt ⅝" diameter—the diameter of the material has increased by .004" during the first upsetting, the final pressing of the head will bring about an increase of another .0078". The

(*Continued on page 174*)

CONTINUOUS WIRE DR

Sleeper & Hartley TRADE MARK

Patented in United States of America and the Principal Foreign Countries



CONTINUOUS ROD FRAME—N

Built with 3, 4 or 5 he

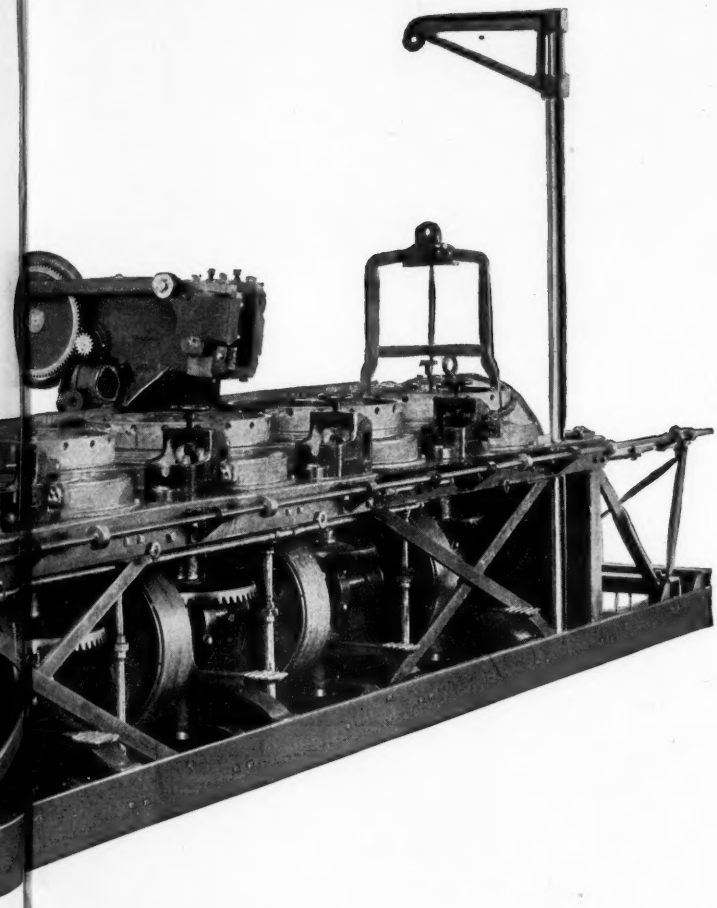
This machine is built without differential gearing of an kin of drawing heads. These machines are put into productio

AGENTS: CHICAGO TERRITORY, Neff, Kohlbusch & Bissell, Inc.

WORCESTER SLEEPER & HA

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London. E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Paris. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels.

RAWING MACHINERY



Sleeper & Hartley TRADEMARK

An All-Ball-Bearing Machine

High Production

Low Maintenance Costs

Machine shown here is set up to draw No. 5 to 15

Runs off 4170 lbs. in 10 hours

AM—No. 5 to 14 or 15 WIRE
o5 heads, as desired

an kind. Automatic compensation for variations in speed
odition immediately after making the motor connections.

HARTLEY, Inc. MASS.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AND FINLAND—Akt., Rylander & Asplunds, Stockholm.

EDITORIAL · IMPRESSIONS

The Versatile Wire

SALESMANSHIP — an art peculiarly modern — is but one of the three industrial graces. The second—a less ostentatious muse—is workmanship. And last—unfortunately often the least—is inventive genius.

The natural ambition of all business enterprise is expansion, and assuming that the workmanship of the product satisfies the requirements of the consumer, the chief influence toward extension of business has been competitive salesmanship. But sales are hopelessly limited and their volume must sooner or later reach a point of saturation. At this point the salesman must seek for new fields to conquer if he would continue the extension. The sale of the particular product in that particular application can increase no further.

Well, let us look then for new applications, says the inventor.

But there is no need to wait till one market is exhausted before seeking new ones. The invention of new uses for the products of an old industry is the surest means of rejuvenation; it is also the most effective way of keeping the industry young.

This fertile source of extended business has been conspicuously neglected by manufacturers of wire. Yet the encouragement of the manufacture and use of new wire products will reflect directly on the wire manufacturer in the form of increased business.

Note, for instance, the interest taken by large electric power companies in the sale of electric appliances; the intelligent and highly effective propaganda spread by these companies in favor of the use of such appliances; and the remarkably successful results as shown by the daily load diagrams of their power plants.

The wire manufacturer is, of course, not in such direct contact with his consumer as our example supposes. Still it is clear that nothing can give such impetus to wire manufacture as new widespread uses of wire, and wire is such a versatile product that its new uses are almost unlimited.

Cold Working

IT is of interest to note the tendency especially manifest in European practice towards the cold working of bolts, rivets and chains of larger sizes. The making of cold headed rivets is, of course, not a new art. It has in fact been traced back to the Egyptians who were known for their rivets in the construction of tools. In 1760, the process was established commercially by the brothers Wyatt who constructed a machine for heading wood screws, and a "cold header" was patented in America some thirty-four years later.*

With the development of cold-upsetting processes, many modern plants are changing from the "hot" equipments to cold working machines, for reasons of increased economy. The defective structure resulting from cold-upsetting has been an obstacle towards the more prevalent use of this process. But several ingenious improvements have been brought about to obviate this difficulty. With a close co-operation of the metallurgist and the designing engineer, cold-working machines could be brought to a stage where their applicability to larger sized products can be demonstrated.

*See Heat treating Cold-Headed Bolts, by H. V. Hillman.

WIRE
& WIRE PRODUCTS

Not a Utopia—a Reality

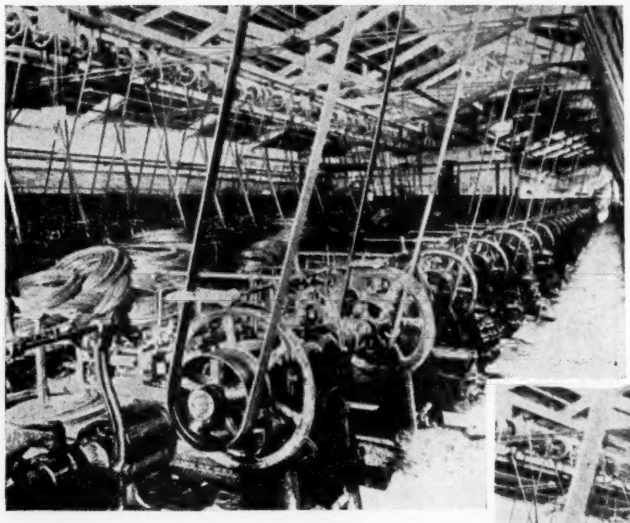
A visitor in the new Ford Wire Mill, familiar with the Ford technique in management will not be surprised to find that unique cleanliness and excellent working conditions that have become characteristic of Ford Plants. To a stranger it might indeed seem that some industrial idealist has wastefully lavished his wealth on superfluous and elaborate installations. But a closer study will reveal the Ford secret: efficiency. If the plant is clean, it is clean in order to be efficient. If special care is given to the comforts of the worker, it is to eliminate unnecessary fatigue and save human energy. If a partially disabled man can do a job, then it is wasteful as well as uncharitable to assign an able bodied man to do it. And the Ford technique succeeds.

We speak above of the Ford secret. But there simply isn't any. Unlike many wire mills, the Ford plant does not work with "secret" processes. The interested visitor is free to inspect what he will. If the plant operates more profitably than others, it is because more attention has been given to labor saving and the elimination of waste. A characteristic example is cited in the article on The New Ford Wire Mill in this issue: A large quantity of copper wire is tinned, but for this purpose the Ford Plant uses pure tin free from lead in order to make brass as a by-product, through the solution of some of the copper in the tin bath. We could cite hundreds of such ingenious methods used in the Ford Wire Mill. Sheer engineering genius, not secrecy assures the Ford success.

Much of Ford practice when set down in print, as in Henry Ford's recently published book, seems visionary. But it works. It is not a Utopia, it's a reality.

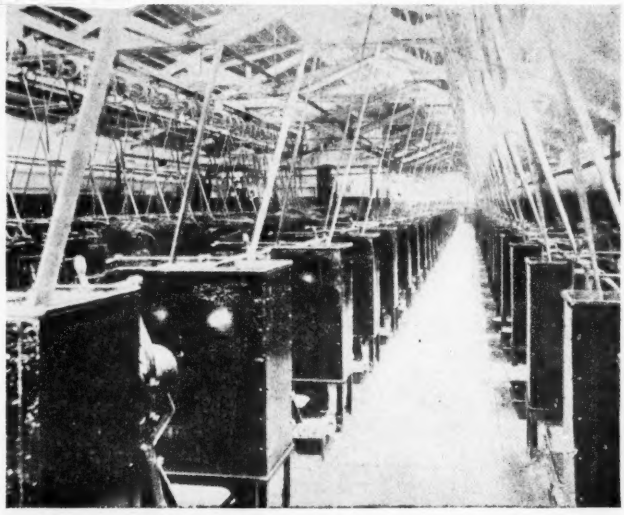
WIRE IN THE NEWS

The drawing of cables through underground conduits is greatly facilitated by this attachment to the repair truck. Photo shows operation of a Mead-Morrison underslung winch.



Reprinted from "The Story of Steel" Harpers.

At left: A row of nail making machines, in the nail department of a large mill showing the dangers of exposed pulleys and swiftly moving belts.



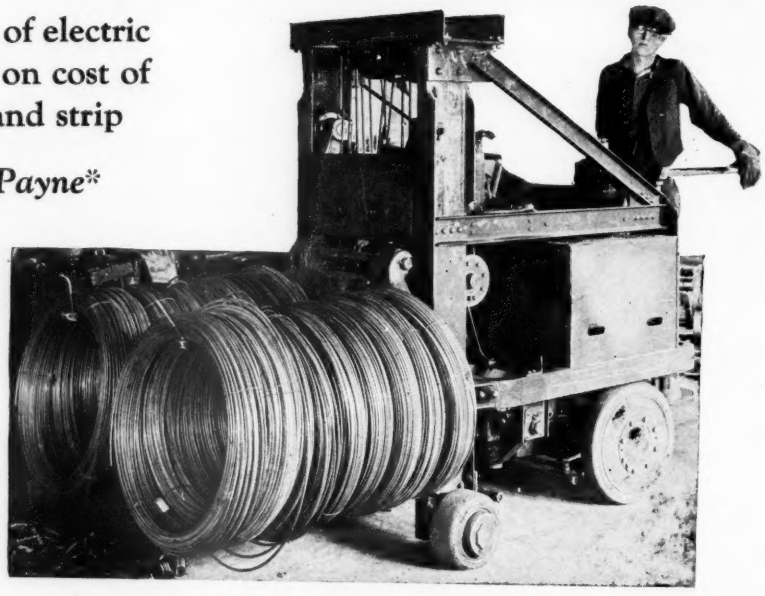
At right: The same nail making machines as above. Belts, pulleys and reciprocating parts have been effectively shielded by placing a stout sheet iron casing around each machine.

If you have photographs of interest to the Wire industry, send them to Wire & Wire Products.

Electric Trucks in Wire Mills

Effects of the use of electric industrial trucks on cost of handling wire and strip

*By Harold J. Payne**



An electric industrial truck handling bundles of wire bound for the shipping room.

THE handling of wire and strip presents many difficulties. The overhead involved where these products are manufactured or used in making other merchandise necessarily reflects these difficulties in a tangible and, frequently, in an unwelcome manner. Wherever manual methods of handling are employed to the exclusion of modern power-operated equipment, there is definite opportunity for decreasing costs which are excessively high. The experience of several users indicates that electric industrial trucks provide an economical solution of the problem.

In understanding this application of storage battery equipment it is necessary to consider the requirements imposed on any mechanical apparatus which is expected to supplant hand labor in the wire mill. Obviously, a prime consideration is flexibility. If a machine is designated for the work, it must be able to go wherever men with hand trucks can go. Another essential is high capacity. Wire is both heavy and bulky as it comes from the rolling mill, and it must be moved promptly to the cooling floor. A third specification is endurance. If men are to be taken from this work, it is necessary to substitute equipment which will perform so that need of reverting suddenly to old methods will not arise, as obviously would be the case in the event of periodic breakdowns. Finally, any mechanical apparatus, to be desirable, must have a past performance record.

Electric Truck Meets Needs

Naturally no single type of equipment can be a panacea for all ailments of inter-plant handling. To be successful, any machine designed to move material must be fitted for its job. However, in a general way it may be stated that the electric industrial truck goes far toward meeting all requirements imposed on equipment for handling wire or strip. This point is best made by looking in on the present practice of several of the users mentioned above.

In one plant copper wire is made in garages from trolley size (9/16 inch diameter) down to fine spool wire (15 mils diameter). The metal is received in ingots weighing 250 pounds and is heated to a bright red. Then the bar is run back and forth through successive dies, being further elongated at each passage until the desired diameter has been obtained. All of the wire products that is sent out finished requires drawing. Before this operation the scale formed during the process of hot rolling must be removed in an acid pickling bath. Finally, after the wire has been carried down to the required size it may or may not be annealed. In the latter case two additional handlings are necessary. From the time the hot rods are received from the rolling machine until the product leaves the plant, every pound of metal must be moved from 5 to 12 times. The cooling floor represents one of the busiest areas in this plant. Rods of wire weighing 250 pounds are delivered here more frequently than once a minute by the rolling machine and must be moved away promptly in order to prevent hopeless congestion. For this reason they are conveyed about eight at a trip, to a cooling area approximately 100 feet distant. From there they go to a weighing platform and thence, for the most part, to the pickling tubs.

One tiering truck, equipped with a ram in place of the usual platform serves to make all of these handlings, working 20 hours a day six days a week. More than a million pounds of wire are moved every day by this machine. Its use has saved the labor of 12 men and has

*Reprinted from The Iron Trade Review.

eliminated from the floor a crowded condition formerly impossible to avoid on account of the variation in activities of hand truckers.

Although the turns made by this truck are short in its run which seldom exceeds 150 feet, records indicate that it is returning very tangible dividends on the investment represented. The floor over which it operates is of corrugated iron placed in squares which do not come together smoothly. In 20-hour service, four changes of battery are necessary. For this reason two batteries are included in equipment, one being constantly on charge while the other is in use.

Cost Of Operation Is Low

Even under the difficult conditions thus imposed the unit involves a fixed charge of only $5.00 a day, including depreciation, interest, maintenance and power. This indicates a net saving equal to the former wages of 10 men. One concern, using similar equipment in much the same work, reports a cost of 24 cents per hour of operation, exclusive of power. In both cases it will be understood that the time of the truck driver is not included.

It is evident that the more trucks which can be kept reasonably busy, the greater the net earning power of the equipment. At the plant in which the ram truck mentioned is working, three elevating platform trucks are detailed to the work of keeping the drawing machines supplied with wire from which the scale has been removed, as well as to keep the product flowing either to the annealing furnace or direct to the shipping room. Skids are so placed at the end of the pickling vats that the hoist running on a monorail over these vats can drop the clean rods directly onto them. The driver of the truck supplying the twenty drawing machines does not operate on a predetermined schedule but is responsible for keeping each worker supplied with wire as required. Usually after dropping a skid load beside an operator, the truck driver picks up an empty skid for return to the pickling room. In this way the cycle is maintained continuously with a minimum of confusion.

Other uses to which these elevating platform trucks are put include practically every other handling incident to manufacture. Drawn wire is supplied to the fine wire department, and the flow of finished wire to the shiping department is conducted entirely on skids. Likewise wire to be annealed is carried to a point directly over the charging chamber of the furnace, and later is carried to the shipping department. All of the runs made by the elevating platform trucks with their skid loads are in aisles largely congested by apparatus installed before the advent of the idea that a plant should be built around the machinery rather than that the machinery should be built somehow to fit into the plant.

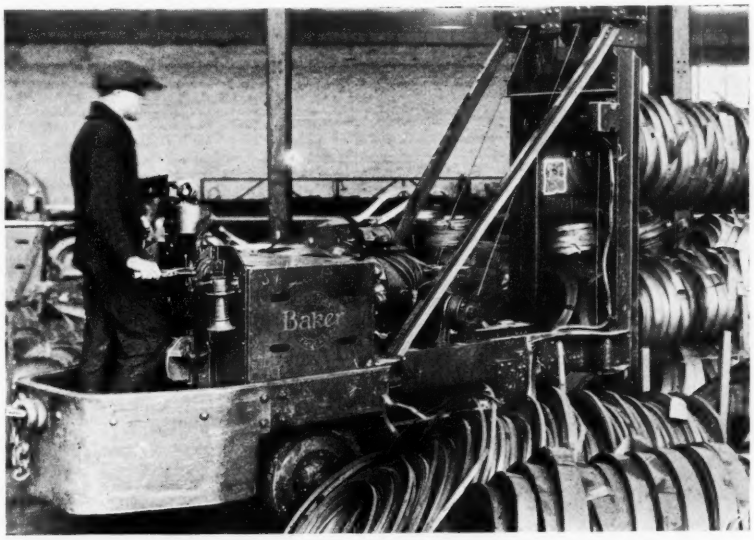
It is impossible to state exactly what balance is struck in the plant as a whole by the use of modern handling equipment. Volume and the nature of the product have changed since the introduction of the industrial electric truck so that a direct comparison is impossible. However, it is generally conceded that when an elevating truck is kept moving, it releases from 5 to 10 hand trucks for other work. The cost of operating this type of machine does not vary appreciably from the figure given for the ram truck. A company that operates a large fleet of these trucks figures the total overhead to be charged against each unit at $3.50 per day.

The crane truck has been found by several users to be well fitted for unloading as well as for loading cars or other vehicles with rods of wire. A large manufacturer of nails, rivets, etc., finds that such a machine saves 80 per cent. over the cost involved in handling wire manually. Formerly it was the custom to handle bundles of wire weighing 150 pounds but with the aid of mechanical equipment of this kind it is found possible to handle 300-pound bundles without difficulty. Consequently every department in the plant has been affected.

Reduces Wire Charging Cost

Operations have been improved in wire drawing, nail and rivet making and in the annealing and galvanizing departments. The machines used are practically automatic in operation so that the only task for the operator is to start the wire going through the machine and to remove the finished material. Therefore, by substitu-

(*Continued on page 173*)



Piling band and hoop stock with an electric crane truck.

Vianney Wire Die Works

(American Branch)

Etablissements Joseph Vianney Trevoux, France

Manufacturers of DIAMOND DIES

New York Offices
100 Fifth Avenue
V. J. Boulin, Mgr.

Diamond Dies

Completely made in this Country by latest scientific method.

New way of re-inforcing the Diamond

R. Kohl, Diamond Die Co.
655 Broad St., Newark, N. J.

The Patented Diamond Die

of proven superiority

through practice and not theory.
The standard of leading wire mills.

Manufactured by:

UNION WIRE DIE CORP.
250 W. 40th St., New York City

Digest of Literature

THE REGULARIZATION OF EMPLOYMENT by H. Feldman, 437 pages. Harper & Bros. 1925.

The prevention of unemployment through the provision of regular work in industry is the central theme of this book. The author shows, as a result of long and careful study, what corporations and industries are now doing to regularize production throughout the year and throughout the business cycle. His discussion shows the methods used in selling and in manufacturing to achieve this steady flow of work, and he includes also the efforts of governmental departments to supply work when industry is depressed.

The book presents valuable data to enable economists, employers, general readers and students of the problem of unemployment to get a better understanding of the ways and means of prevention of unemployment.

Wire Rod Mills, by J. D. Wright, General Electric Rev., vol. 29, P. 380, June 1926.

The electrification of wire rod mills is discussed on the basis of a detailed analysis of rod-mill loads. A general historical treatment of the development in wire-rod rolling is given.

Elasticity of Wires and Cables, by H. W. Swift Engineering vol. 121 P. 547-8, P. 615-17, Apr. 30, Mar. 28, 1926.

A discussion of the elasticity of wires with special reference to electrical overhead work and aerial ropeways. Methods for determination of the modulus compared and an account of tests to determine the comparative accuracy and reliability, is presented. The articles are illustrated, and are accompanied by brief mathematical treatment.

The Cold Drawing of Bar Steel. By F. W. Krebs. In Mechanical Engineering, May 1926, page 448.

In this article, the author sets forth the object of cold finishing and enumerates the four purposes for which the cold drawing or cold rolling may be employed. The pickling process is described, the cleansing of the bars and the pointing. He then describes the dies used and also the drawing of the steel, after which he takes up the manner of finishing the bars. The factors affecting the machining qualities are considered and the writer is of the opinion that grain structure and hardness largely determine the machinability of steel. The physical properties of several steels and comparative results between various methods of processing are tabulated.

On The Heat Treating At The Drawing Of The Steel Wire. By S. Steinberg, Journal of the Russian Mettalurgical Society 1925, 1, 131.

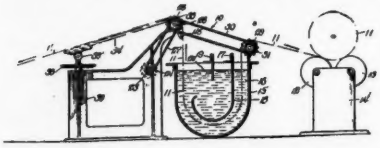
Considering the mechanical characteristics of the steel wire, obtained by tempering and subsequent drawing, the author concludes that the metal of the wire shows a remarkable combination of the qualities of strength and tenacity; a similar combination can be stated only in special steels after their heat treating. The mentioned amelioration of the qualities of carbon steel is explained by two reasons—the sorbitic structure of the metal and its cold working. The author forwards the question were it not possible to use more widely the advantages of the mentioned treating and apply it to larger articles—rails, beams, etc.

Abstracted by M. Oknoff and G. N. Koulginski, Leningrad, Russia, for the transactions of the A. S. S. T.

Review of Patents

Conducted by
EUGENE GRUNSTEIN

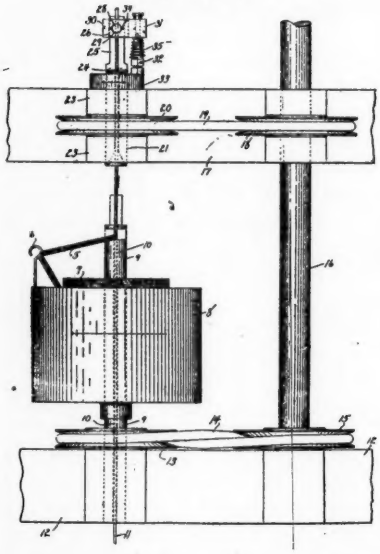
Coating Wire Fabric.



The method of coating metal fabric having loosely connected independently movable members which includes moving the fabric through a coating bath; delivering the fabric on an inclined support, the inclinaton of the support being such as to cause the fabric to move therefrom by effect of gravity at a speed to separate said members.

United States Patent No. 1,592,206, issued to N. S. Harter, Waukegan, Ill., assignor to Cyclone Fence Co.

Electric-Wire-Wraping Machine.



In a machine for wrapping electric wire, the combination seperately-organized wrapping and polishing units, of means for revolving the same in opposite directions around the wire, as the same is successively subjected to the action of the aid independently-organized wrapping and polishing units.

United States Patent No. 1,594,492, issued to Ernest G. Brown, New Haven, Conn., assignor to The Acme Wire Co., New Haven, Conn.

Hairpin.

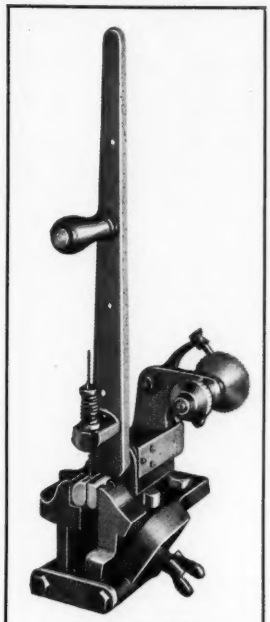
Aother species of the genus hairpin. U. S. Patent No. 1,594,933 issued to Ida M. Durand, St. Louis, Mo.

Chromium Coating on Iron

Experiments of the inventor have shown that satisfactory chromium coatings of iron and steel were not to be obtained by the well known method. The coatings obtained were more or less brittle and did not adhere well to the core. The inventor has shown that the carbon content of the iron or iron alloys was the reason of the failure and that this hitherto unknown disturbing effect of carbon is due to the pressure of cementite or another mixed chromium-iron-carbide formed at high temperatures, which prevents the diffusion of chromium into the core.

Using the aforesaid results of experiment, the inventor solved the problem of coating iron and iron alloys with chromium by artificially producing at least a superficial zone free or nearly free of carbon in or on the iron body to be coated.

U. S. Patent No. 1,590,101 issued to Spiro Kyropoulos, of Gottingen, Germany, June 22, 1926.



Amsler's Wire Ductility Tester

The "Usefulness" of Wire in the Manufacture of Wire Products depends in Most Cases upon its "Ductility"

The best apparatus for investigating the ductility of round and flat wire, ferrous and non-ferrous, is the "Amsler Reversed Bending Tester" illustrated above.

This apparatus gives very valuable information. It can be operated by any intelligent man in the shop and it is inexpensive.

Every wire forming shop should be equipped with this handy, practical wire tester. Some plants are using a number of them in different departments.

Write for Full Description

HERMAN A. HOLZ

Testing Engineer
17-B Madison Ave. New York

Complete Line of High Quality Metal Testing Machines.

NEWS OF THE INDUSTRY

New German Barbed Wire

A NEW machine for barbed wire of one strand has recently been patented by a German manufacturer. Two German manufacturers have been licensed for the sole production of this "Wafios" barbed wire. The prices per ton are higher than the usual two-strand wire. One thousand kilograms of wafios wire has a length of 15,153 meters. (B. W. G. No. 13) and of usual barbed wire only 8,600 meters. The buyer of wafios wire is getting, if buying one ton, about 75% more wire and is paying 50 to 60% more for it.

Pin Companies Unite

Realizing the advantages of combined operations, the New England Pin Company of Winstead, the Star Pin Company of Derby and the National Pin Company of Detroit recently concluded an important merger.

The Winstead and Derby Companies are capitalized at $700,000 and the National Pin Company represents a capital of $150,000. They will carry on combined operations in Derby.

THE Southern Wire & Iron Works, Inc., 55 Martin Street, Atlanta, Ga., is said to have preliminary plans for a one-story addition, 200x200 ft., for the manufacture of metal window guards, ornamental iron, wire specialties, etc.

ACCORDING to THE WORCESTER, MASS., The American Steel and Wire Co. is operating on an unusually prosperous basis. The three plants of this company have been shipping for several months at a greater rate than at any previous time since the war.

THE Wheeling Steel Corporation, Wheeling, W. Va., has appointed H. E. Smith, St. Louis, sales manager. Mr. Smith succeeds A.H. Dufort, who resigned to become assistant manager of sales for the Central Tube Co.

THE Adrian Wire Fence Co., Adrian, Mich., has taken over the business of the Michigan Wire Fence Co., also of Adrian, including the rights, patterns and inventory of the latter company's stretcher business. The sales organization of the Adrian company will take over sales of both companies and the manufacture of fence by the Mirchigan Wire Fence Co., will be discontinued.

THE Wickwire Spencer Steel Corporation, Worcester, Mass., has sold three brick plants containing approximately 73,000 ft. of manufacturing space, formerly used for the manufacture of wire goods and specialties, to the Morgan Construction Co., of that city.

H. F. Kluender, for several years connected with the Kinite Co., Milwaukee, has been appointed representative of the Ziv Steel & Wire Co., Chicago, in the Detroit district.

THE Harrison Bolt & Nut Co., Harrison, N. J., will erect a warehouse and office building as an extension to its plant. Plans and specifications are by J. M. Baker, Harrison, architect. The general contract will be awarded August 30.

THE MASTER DIE

PRODUCES A BRIGHTER CLEANER AND MORE ACCURATE WIRE

FOR FULL PARTICULARS WRITE TO

MASTER WIRE DIE CORPORATION

408 Concord Avenue New York, N. Y.

JOHN FAHNLINE, Sr., of Sharon, Pa., passed away at Ipswich, Mass., on Friday, Aug. 13, while on an automobile tour through the New England states.

Mr. Fahnline was well known in the Rod and Wire trade—in which business he was engaged for the greater part of his active career.

In 1888 he became associated with John Stevenson, Jr., in the construction and operation of the Rod & Wire Mills of the New Castle Wire Nail Company at New Castle, Pa.

In 1899 Mr. Fahnline undertook the construction and operation of the rod and wire departments of the Sharon Steel Company at Farrell, Pa. Later, he became associated with Mr. Stevenson in the Driggs-Seabury Ordnance Corporation at Sharon, and continued with those interests until his retirement from active life about nine years ago. He was 68 years of age at the time of his death.

Contributed by Geo. A. Paff.

Statistics in Prevention of Accidents.

F. W. CHANEY, of the Bureau of Labor Statistics in the Department of Labor, analyzed the statistical factor in accident experience of the iron and steel fields at the recent conference on Industrial Accident Prevention.

In 1906 the head of the legal department of the U. S. Steel Corporation called a conference of the casualty managers of the subsidiary companies. One purpose of this conference was to consider the statistics of accident occurrence. From that day to this the corporation has assembled and published statistical data concerning accidents. Some details are given below.

If 1906 be compared with 1925 a reduction of 60 per cent. is found to have occurred. If lost time cases are noted the reduction is 80 per cent. from 1912 to 1925. Let it be supposed

Wire Drawing Soaps and Compounds

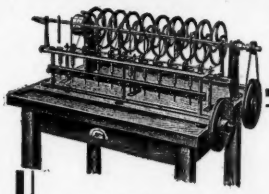
STEELSKIN BRAND
(Registered)

For High or Low Carbon Wire

Working Samples sent on request.

Established 21 years.

R. H. MILLER CO., INC. **HOMER, N. Y.**



"POHENKRA" WIRE DIE POLISHING MACHINE

Indispensable For All Kinds of Wire-drawing

U. S. Patents
983929—1911
1039186—1912
England 16171
1910
France 420503
Germany 226062
Austria 46339

Gives an absolute guarantee of grinding the diamond holes perfectly round, a result hard to accomplish with all devices employed before.

Simultaneously grinds the entire wall of the draw stone, including the inlet and outlet.

Ten times more effective than previous devices; one workman unassisted can polish 30 diamonds simultanously.

Write For Descriptive Literature

F. KRAUSE & CO., Inc., 250 Ogden Ave., Jersey City, N. J.

KILMER LITTLE GIANT WIRE FORMER

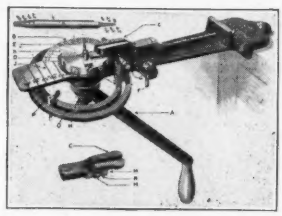
Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.

Adjustable for No. 3 to No. 24 Gage Wire.

The cut on the left shows a few of the thousands of the forms made on this

FORMER

Price $35.00



Patented April 2, 1918

M. D. Kilmer & Co.

Cleveland, Ohio, U. S. A.
Box 237, Station B.

EST. 1885 AIMCO INC. 1918

"American" INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

517 Huntington St.
PHILADELPHIA PENNSYLVANIA U.S.A.

Machinery for Insulating MAGNET WIRE

with Cotton—Silk—Enamel —Paper and Other Tape

BREGUET HIGH-SPEED WIRE DRAWING MACHINERY

ENAMELING MACHINE (Heavy Model)
For Wire 10 to 20 B. & S. Gauge.

Continuous Wire Drawing Machine

A light, compact, and inexpensive machine of the ball bearing type, for rapid and economical production of fine wire.

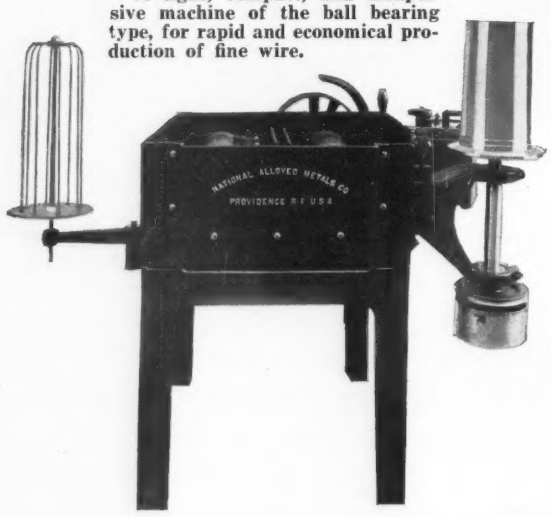


Illustration features No. 2 Machine. Capacity No. .20 B & S to .003.
We will furnish information on other sizes.

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Chicago

that conditions of 1906 were time, the 48,863 more workers would have suffered serious injury than the actual number. If 1912 conditions had been continued it would have meant 322,-463 more disabling injuries than actually occurred.

The reduction accidents in the manufacture of steel and iron wire products amounted to 88 per cent. over eight years from 1913 to 1921.

Wire in the Delaware Bridge.

(*Continued from page 157*)
metal left at the root of the first thread.

Spinning the Cables.

The methods used for spinning the cables were basically the same as those developed on the Brooklyn and earlier suspension bridges, although much speeded up by improved footbridges, a greater number of traveling sheaves and the use of machinery and special tools. Essentially the process consists in carrying across the river a bight, or loop, of wire by means of a traveling sheave hung from and moved by a carrier rope. designated the "haulage" rope. Large reels containing about 90,000 feet of wire were mounted on the anchorages and the wire unwound as the sheaves moved across the river.

The Footbridges.

The footbridges were temporary structures used to support the haulage ropes and other construction plant and to give access to the cables during construction. They were built across the river a few feet below and parallel to the cables. Each footbridge was ten feet wide, with flooring consisting of six-inch boards spaced two inches apart. This spacing of the boards afforded a foothold for the men, although in the most inclined portions, adjacent to the towers, it was necessary also to place cleats on the boards in order to prevent slipping. Each footbridge was supported by six 2¼-inch steel ropes arranged in two sets of three each, and braced by lengths of the same kind of rope

strung beneath them. These ropes were later used in hanging the steel structure. Cross-over bridges of timber truss construction were provided to brace the footbridges and to give access between them.

Electric Trucks in Wire Mills.

(*Continued from page 167.*)

ting 300-pound bundles for 150-pound bundles, the machines have to be charged only half as often. In other words, the cost of charging the machines is cut in two and since it takes more of the operator's time to start the wire through the machine than it does to remove the finished product, this cost is more than half of the labor required in manufacturing. As machines have to be shut down under the new system approximately half as often as previously, the increase in capacity is apparent.

The product from two hot strip mills had been taken care of formerly by four gangs of three men each, and as fast as the hot rods came from the rolling mills they were wheeled away by hand. Periodically it was necessary to shut down the entire plant to clear up the storage floor because of congestion, and a large amount of product had to be scrapped because of injury through this method of handling.

The installation of ram trucks for carrying away the rods did not solve the problem immediately because of the congestion existing at the time these machines were put into service. However, within a few weeks conditions began to improve; periodic shut-downs were eliminated and the earning power of the trucks became so high that they were paying for themselves once every month out of savings. Although the trucks used have now been in 24-hour service for two and one-half years, this record is being maintained at present.

The practice of other plants which are using equipment of this kind might be described, as further concrete instances of performance.

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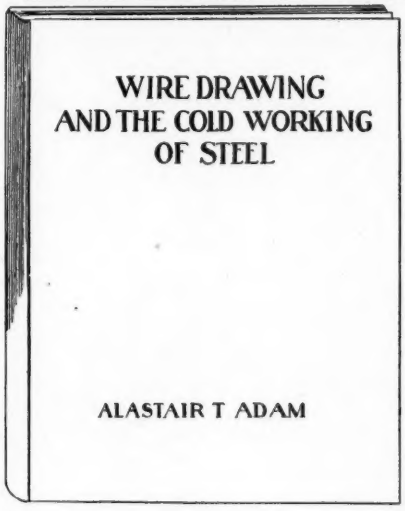
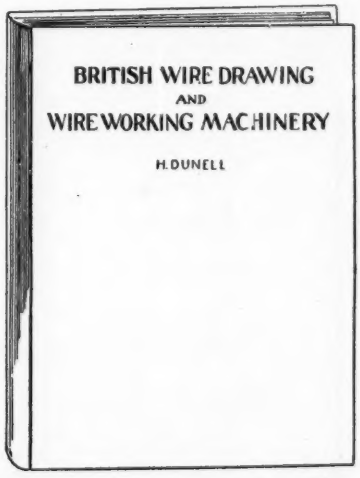


$13.00

No books dealing exclusively with this subject have been printed in recent years.

They should be in every wire mill.

$7.50



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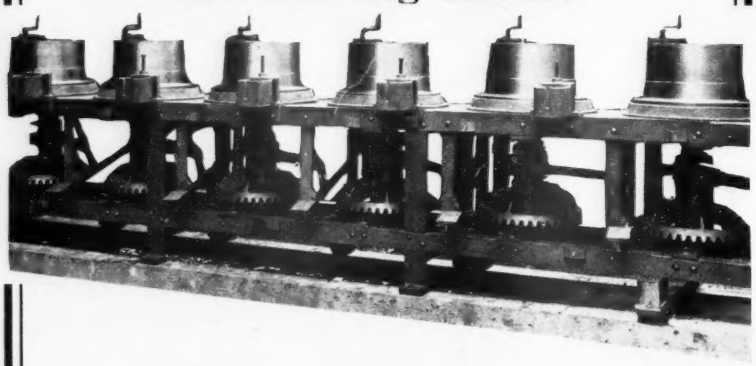

Photograph shows one section of six blocks

This machine can be supplied with either single or double decker blocks.

Floor space required 2′ by 23′

Designed and Manufactured by

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172 UNION ST., WORCESTER, MASS.

European Bolt and Rivet Practice

(*Continued from page 161*)

material necessary for this increase can be taken only from the material forming the head before the upsetting. Therefore it is required that the surface on which the head is resting be stretched in proportion to the quantity of material which enters the die bore. In Fig. 2 one can see the amount of the stretching marked by the dotted line which shows the shape of the head before the upsetting. "h" varies according to the diameter of the bolt because the pressure of the dies cannot be kept constant. This enforced changing of the original shape of the head involves a shearing of the outside fibres of the material in the section between head and shaft and a breaking of the fibres in this section. These facts combined give the reasons for the separating of the head of the bolt from the shaft.

This shearing must be prevented, i. e. the breaking of the fibres must be removed from the dangerous section. This was brought about by means of a new method of pressing in the following way: After the upsetting of the head of the bolt the knock-out pin makes the bolt advance in proportion to the quantity of material which follows, i. e. in Fig. 2. equal to "h". As the material is not taken from the head and the fibres are not subject to shearing, we have the conditions represented by Fig. 3. which shows the etched and ground surface of a longitudinal section. One can see that the section between shaft and head is not impaired, while the breaking of the fibres is removed toward the middle of the head. The practical effect was evident at once by the fact that even non-annealed heads did not come off which makes it unnecessary to carry out the annealing with the care required previously.

With this new method of pressing there are connected

other valuable improvements which, in order to obtain better economy and safety in operating, were leading to the development of a new type of combined cold-working double-stroke press for bolts and rivets. As already emphasized by name of the type, this machine makes it possible to manufacture bolts by means of open dies and rivets by means of solid die requiring merely a changing of the tools. The unheated-rods are inserted into the matrix independent of the movement of the die because of the ingenious and reliably

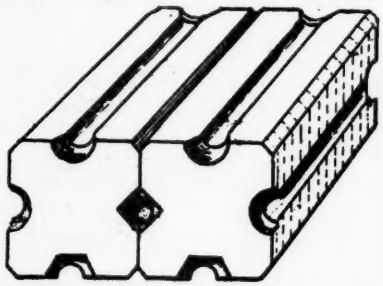

Fig. 4. A "quadruple" die for bolts, for four different shafts and eight different heads.

working shearing and inserting device. This has the advantage of a great saving of tools because for the manufacturing of bolts of any lengths only one pair of dies is required, the cuting being done independent of the length of the dies by means of a special shearing device. In addition different die shapes may be cut (Fig. 4.) in the various sides of one pair of dies. Furthermore the end surfaces can be provided with four different end-shapes making it possible thereby to use one pair of dies for eight different shapes of heads and thus eliminating expensive tools.

After an elapse of two years the tube mills at the Zanesville, Ohio, works of the Youngstown Sheet & Tube Co. will resume operation.

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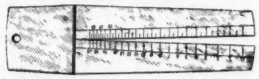

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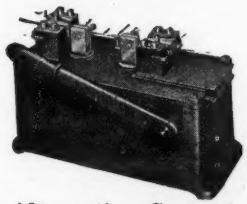

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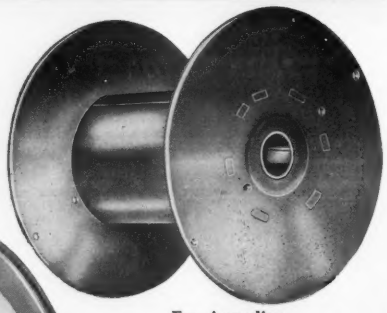

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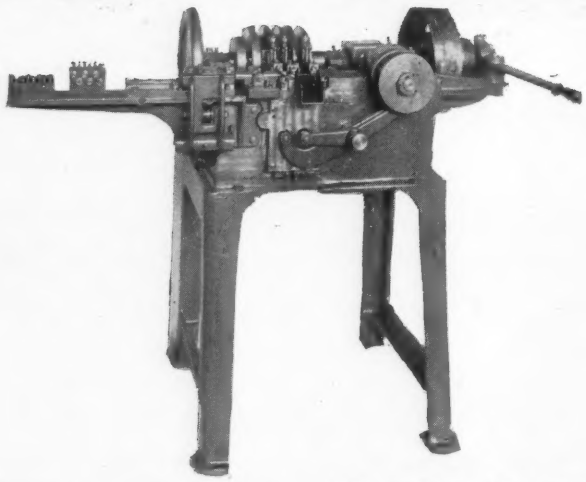

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10-12 Brookdale Place, Mt. Vernon, N. Y.

The Profits of High Overhead

(*Continued from page 155*)

Most of our customers, however, welcome our men

Not every customer appreciates this engineering service, of course. Some few of our customers object to our sending men to them. They consider that we are meddling into their affairs, and on occasion even refuse to admit our men for fear they will learn and subsequently disclose "trade secrets."

Most of our customers, however, welcome our men because they see the advantage to themselves of having an expert on magnet wire and coils come in to look over their manufacturing.

Only a few months ago a manufacturer notified us that our price was too high, and that he would have to find other sources of supply.

I went to see him. "Why do you feel you can't buy of us any longer?" I inquired.

"We have an offer of the same thing for 7% less, was his answer. "The trouble with you folks is that you have such a complete organization it makes your overhead too high."

"Of course, you realize that you have profited by our having a complete organization at a high overhead," I reminded him.

"I'd like to know how," he asserted belligerently.

"All right," I assured him. "I'll tell you how. Do you recall that about nine months ago you were having serious trouble in your winding department?"

"Ye-es." grudgingly.

"Do you remember sending for one of our engineers to see what he could do for you?"

"Yes."

"I looked up that correspondence before I left the factory," I explained. "When it was all over, and our man had shown you what was wrong and how to fix it, you yourself wrote us expressing your appreciation. And you told us the trouble was shown up as unquestionably

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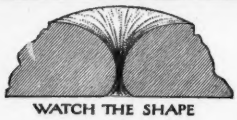
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more than 60% your own fault. Remember it now?"

"Yes, I remember it."

"Don't you think it is worth 7% more for our material, which is a small part of your total material cost, to encourage us to provide that sort of service, and to have it available next time you get into difficulties?"

"Not 7%," he declared blandly. "If you can't meet the other price, we'll buy elsewhere."

So we lost the contract. But that is part of the game.

The leaders are committed to a policy of generous overhead

Not every customer who profits by our engineer's advice continues to buy of us, of course. With human nature what it is, this is only to be expected.

A far greater proportion of our customers stay with us year after year, paying us a little more for our products than they might buy comparable articles for at some other source. Thus they express in tangible form their approval of our policy.

Again let me emphasize that I am not advocating a reckless expenditure of money by any business. That is patent folly.

But I am endeavoring to bring out into broad daylight an idea which is at variance with the commonly accepted thought about overhead, and to back it up with instances chosen out of our own business experience. And this idea, stated as briefly as I know how to state it, is as follows:

A high rate of overhead is not, by its very existance, to be condemned. Every line of business, every industry has its leaders and its followers; it looks to the leaders for its progress. And the leaders, almost without exception, are those whose overhead is not so low as it might be.

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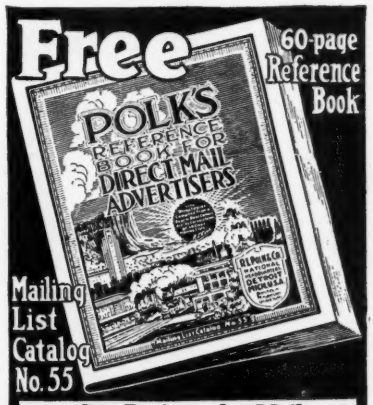

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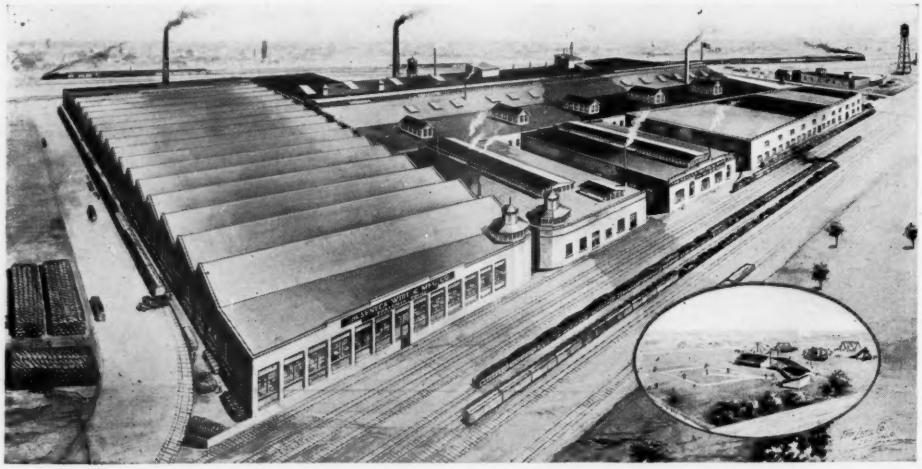

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